# TENNESSEE MATHEMATICS TEACHERS' ASSOCIATION

## FIFTY-NINTH ANNUAL MATHEMATICS CONTEST

## 2015

## Algebra I


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Scoring formula: 4 x (Number Right) – (Number Wrong) + 40

DIRECTIONS:

Do not open this booklet until you are told to do so.

This is a test of your competence in high school mathematics. For each problem, determine the best answer and indicate your choice by making a heavy black mark in the proper place on the separate answer sheet provided. You must use a pencil with a soft lead (No. 2 lead or softer).

This test has been constructed so that most of you are not expected to answer all of the questions. Do your best on the questions you feel you know how to work. You will be penalized for incorrect answers, so wild guesses are not advisable.

If you change your mind about an answer, be sure to erase completely. Do not mark more than one answer for any problem. Make no stray marks of any kind on the answer sheet. The answer sheets will not be returned to you; if you wish a record of your performance, mark your answers in this booklet also. You will keep the booklet after the test is completed.

When told to do so, open your test booklet and begin. You will have exactly eighty minutes to work.

## TMTA Algebra I Exam - 2015

1. In the coordinate plane, what is the midpoint of the line segment with endpoints (-3 -5) and (5,7)?

   a. (1, 1)  b. (1, 6)  c. (3, 3.5)  d. (4, 6)  e. (8, 12)

2. Disregarding sales tax, how much will you save when you buy an $11 compact disc that is on sale for 25% off?

   a. $0.28  b. $0.44  c. $2.75  d. $3.00  e. $8.25

3. Given the two functions *f(x)* and *g(x)*, tables of values are shown below. What is the value of *g(f(3))* ?

| *x* | *f(x)* |
|---|---|
| -5 | 7 |
| -2 | -5 |
| 1 | 3 |
| 3 | 2 |

| *x* | *g(x)* |
|---|---|
| -2 | 3 |
| 1 | -1 |
| 2 | -3 |
| 3 | -5 |

   a. 5  b. -3  c. -1  d. 2  e. 7

4. Elliott writes a check for $15. He records the check in his check register, which up to this time has shown the correct balance. When figuring his new balance, he accidentally *adds* $15 instead of subtracting. The balance in his check register now shows:

   a. $30 less than it should  b. $15 less than it should  c. The correct amount

   d. $15 more than it should  e. $30 more than it should

5. Find the slope of the line that passes through the points $(a+3, b-2)$ and $(a-5, b+6)$.

   a. -4  b. -2  c. -1  d. $-\frac{1}{2}$  e. $-\frac{1}{4}$

6. If a, b, and c are positive integers such that $a^b = x$ and $c^b = y$, then $xy =$

a. $ac^b$ b. $ac^{2b}$ c. $(ac)^b$ d. $(ac)^{2b}$ e. $(ac)^{b^2}$

7. Which of the following equations has no solution?

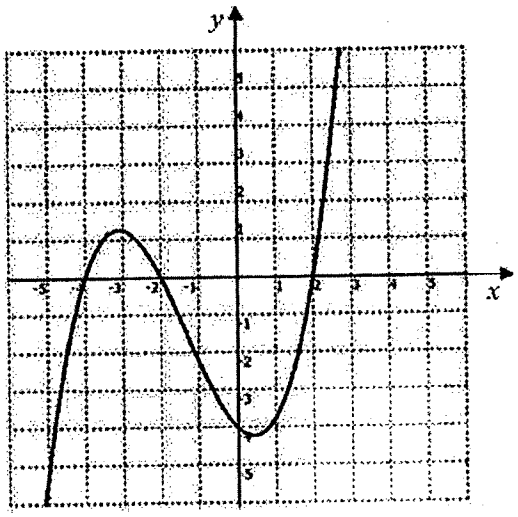
a. $3(2x-5)=2(3x+1)$ b. $3(2x-5)=2(4x+1)$ c. $3(2x+5)=2(2x-1)$

d. $3(2x-5)=3$ e. $3(2x-5)=0$

8. What is the $50^{th}$ term in the sequence 1, 4, 7, 10, 13, . . . ?

a. 142 b. 145 c. 148 d. 151 e. 154

9. Using the function, $f(x)$ graphed below, which of the following is true?




a. $f(-1)$ does not exist

b. $f(-1) = 0$

c. $f(-1) = -2$

d. $f(-1)$ has two answers

e. $f(-1)$ has three answers

10. What is the y-coordinate of the solution to the system $\begin{cases} 2x-3y=10 \\ 6x+4y=-9 \end{cases}$ ?

a. -3 b. -2 c. ½ d. 2 e. 3

11. If $A=\frac{1}{x}$ and $B=\frac{x+3}{2x^2+6x}$, then which of the following is true for $x>0$ ?

a. $A=B$ b. $A>B$ c. $B>A$ d. $A\geq B$ e. $B\geq A$

12. One of the solutions of $2x^2-5x+3=0$ is . . .

a. $-\frac{3}{2}$ b. -1 c. $\frac{1}{2}$ d. 1 e. 3

13. Yvette earned a score of 56 on a recent 25-question multiple-choice exam. The scoring for the exam was +6 for each correct answer, -2 for each incorrect answer, and 0 for each unanswered question. What is the *maximum* number of questions Yvette could have answered correctly?

a. 9 b. 10 c. 11 d. 13 e. 14

14. If the price of fertilizer has been decreased from 3 pounds for \$2 to 5 pounds for \$2, how many more pounds of fertilizer can be purchased for \$10 than could have been purchased before?

a. 2 b. 8 c. 10 d. 12 e. 15

15. If $\frac{m^5n^2}{p^3}$ is divided by $\frac{m}{np}$, the result is . . .

a. $\frac{m^6n}{p^4}$ b. $\frac{m^4n^3}{p^2}$ c. $\frac{m^4n}{p^2}$ d. $\frac{p^4}{m^6n}$ e. $\frac{p^2}{m^4n^3}$

16. If a, b, and c are consecutive odd integers, which of the following must be true?

I. $a+b+c$ is odd

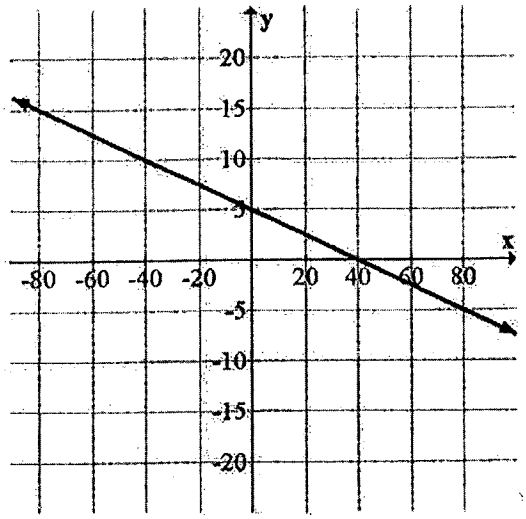
II. $abc$ is odd

III. $\frac{ab}{c}$ is odd

a. I only b. II only c. III only

d. I and II only e. I, II, and III

17. A line drawn perpendicular to the line on the graph below would have what value for its slope?




a. -8

b. -1/2

c. -1/8

d. 2

e. 8

18. In a downhill ski race, Margo posted a time of 2 minutes and 24 seconds for a course 1.2 miles long. About how many miles per hour did she average for the race?

a. 60 b. 30 c. 20 d. 3 e. 2

19. In the standard (x, y) coordinate plane, the graphs of the 3 equations $x=1$ , $y=-2$ and $x+y=4$ form the boundary of a triangle. What is the area of this triangle, expressed in square coordinate units?

a. 1/2 b. 9/2 c. 8 d. 25/2 e. 49/2

20. An album contains $x$ black-and-white photographs and $y$ color photographs. If the album contains 24 photographs, then which of the following CANNOT be true?

a. $x=y$ b. $x=2y$ c. $x=3y$ d. $x=4y$ e. $x=5y$

21. A line that is parallel to $6x-4y=16$ and passes through the point $(-2,2)$ should also pass through which of these points?

a. $(4,-22)$ b. $(4,-7)$ c. $(4,1)$ d. $(4,6)$ e. $(4,11)$

22. If $a<0$ and $b>0$, then the sum of $a$ and $b$ :

a. is always positive  b. is always negative  c. is always zero

d. can be any real number  e. cannot be zero, but can be any other real number

23. If $npq=12$, and $\frac{p}{q}=4$, then $n=$

a. $\frac{3}{q^2}$  b. $\frac{3q}{p}$  c. $3p$  d. $4p$  e. $\frac{pq}{12}$

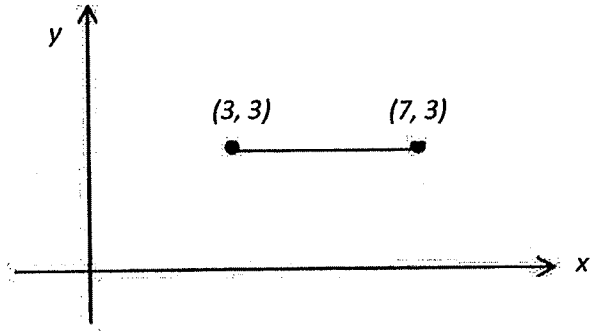
24. Find the solution to the inequality: $2(x-1)<\frac{8x-4}{3}$

a. $x<-1$  b. $x>1$  c. $x<1$  d. $x>-1$  e. $x>5$

25. Every day a vending machine dispenses $k$ cups of coffee, each at a cost of $c$ cents. During a period of $d$ days, what is the amount of money in dollars taken in by the vending machine from the sale of coffee?

a. $\frac{100kc}{d}$  b. $\frac{kcd}{100}$  c. $\frac{dk}{c}$  d. $kcd$  e. $\frac{kc}{100d}$

26. In the figure below, the line segment joining the points (3, 3) and (7, 3) forms one side of a square. Which of the following points CANNOT be another vertex of the square?




a. (3, -1)  b. (3, 7)  c. (7, -3)  d. (7, -1)  e. (7, 7)

27. If set A = {(-2, 3); (-1, 1); (-4, -5)} and set B = {(3, 4); (4, 3); (2, -1)}, how many lines can be drawn with a positive slope from one point is set A to one point in set B?

a. 2  b. 3  c. 4  d. 5  e. 6

28. If a graph of a line in the coordinate plane includes the points (2, 4) and (8, 7), what is the x-intercept of the line?

a. -6 b. - 3 c. 0 d. 3 e. 6

29. Find the y-coordinate of the solution to the system $\begin{cases} x+ay=6 \\ 3x+5y=10 \end{cases}$, in terms of $a$.

a. $\frac{8}{3a-5}$ b. $\frac{6}{a}$ c. $-4a$ d. $\frac{-4}{a}$ e. $3a-13$

30. The average of 8 numbers is 6. The average of 6 other numbers is 8. What is the average of all 14 numbers?

a. 6 b. $6\frac{6}{7}$ c. 7 d. $7\frac{2}{7}$ e. $8\frac{1}{7}$

31. If $n$ is a negative number, which of the following is the <u>least</u> in value?

a. $-n$ b. $n-n$ c. $n+n$ d. $n^2$ e. $n^4$

32. If $|4x-8|<12$, which of the following defines the possible values for $x$?

a. $-8<x<-4$ b. $-4<x<8$ c. $-1<x<5$

d. $1<x<5$ e. $4<x<8$

33. In a certain year, the number of girls who graduated from City High School was twice the number of boys. If ¾ of the girls and ⅚ of the boys went to college, what fraction of the high school graduates went to college?

a. $\frac{5}{36}$ b. $\frac{7}{9}$ c. $\frac{16}{27}$ d. $\frac{29}{36}$ e. $\frac{31}{36}$

34. Paul walked from point P to point Q and back again, a total distance of 2 miles. If he averaged 4 miles per hour on the trip from P to Q, and 5 miles per hour on the return trip, what was his average walking speed in miles per hour for the entire trip?

a. $2\frac{2}{9}$ b. 4 c. $4\frac{4}{9}$ d. $4\frac{1}{2}$ e. 5

35. If the sum of five consecutive integers is 40, what is the smallest of the five integers?

a. 4 b. 5 c. 6 d. 7 e. 8

36. Given the equation $2x^2 - 2x = 12$, what is the sum of the two solutions?

a. -5 b. 1 c. $3\frac{2}{3}$ d. $3\frac{1}{2}$ e. 5

37. If $8^x = 2^{x+3}$, then $x = ?$

a. 0 b. 1 c. $\frac{1}{3}$ d. 3 e. $\frac{1}{2}$

38. What is the sum of the real roots of the (eighth order) polynomial equation $(x^2 - 6x + 3)(2x^2 - 3x + 7)(2x^2 - 3x - 7)(x^2 + 4x - 1) = 0$?

a. $\frac{5}{2}$ b. 5 c. $\frac{7}{2}$ d. 2 e. $-\frac{3}{2}$

39. If $(x+1)(x-2)$ is positive, then which of the following is true?

a. $x < -1$ *or* $x > 2$ b. $x < -2$ *or* $x > 1$ c. $-1 < x < 2$

d. $-2 < x < 1$ e. $x = -1$ *or* $x = 2$

40. Mrs. Bell teaches Algebra I at Duncan County High School. Six boys left the room, leaving three girls for every two boys. Then 18 girls left, leaving four boys for every three girls. How many students were in Mrs. Bell's class initially?

a. 30 b. 36 c. 60 d. 66 e. 72